



TITLE:

FREIGHT TRANSPORT NETWORK DESIGN  
WITH SUPPLY CHAIN NETWORK  
EQUILIBRIUM MODELS AND PARTICLE  
SWARM OPTIMISATION ALGORITHMS(  
Digest\_要約)

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CITATION:

Febri Zukhruf. FREIGHT TRANSPORT NETWORK DESIGN WITH SUPPLY CHAIN NETWORK EQUILIBRIUM MODELS AND PARTICLE SWARM OPTIMISATION ALGORITHMS. 京都大学, 2014, 博士(工学)

ISSUE DATE:

2014-09-24

URL:

<https://doi.org/10.14989/doctor.k18568>

RIGHT:

学位規則第9条第2項により要約公開; 許諾条件により要約は  
2015/09/10に公開; 許諾条件により要旨は2014/12/20に公開

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論文題目	FREIGHT TRANSPORT NETWORK DESIGN WITH SUPPLY CHAIN NETWORK EQUILIBRIUM MODELS AND PARTICLE SWARM OPTIMISATION ALGORITHMS（サプライチェーンネットワーク均衡モデルと粒子群最適化法を用いた貨物輸送ネットワークの設計に関する研究）		
<p>（論文内容の要旨）</p> <p>This thesis deals with the supply chain network equilibrium models for designing the freight transport network. It consists of 7 chapters, which can be summarized as follows.</p> <p><u>Chapter 1</u> explains the background of the research, research motivations and objectives of the research. Freight transport is one of today's most critical issues, not only by its growing significance, but also by supporting the economic development of cities, regions, and countries. Freight transport plays important roles in goods movement along a supply chain, and hence it directly influences the efficiency of supply chain network (SCN). The development of theoretical foundations on logistics and supply chain discipline has allowed researchers to view freight transport planning not only from the aspect of transport network (TN), but also from that of SCN, taking into account their interactions (i.e. TN-SCN interactions). By considering the TN-SCN interactions, administrators and/or transport planners have opportunities to understand the mechanisms of goods movement on SCNs as well as to investigate the effects of freight transport measures on them. Therefore, this thesis attempts to develop models for optimally designing freight transport with the TN-SCN interactions being taken into consideration.</p> <p><u>Chapter 2</u> reviews the related research on the freight TN design to be handled in this thesis, and discusses the challenges and requirements for developing the freight TN design model. The first section introduces a conceptual model of network design problem (NDP), with a specific interest in the discrete NDP (DNDP). The related research on the network interdiction problem (NIP) is also described in the second section, since there is a good possibility to deal with the NIP by changing the perspective of objective function on the DNDP. Mathematical programmes with equilibrium constraints (MPEC) can be used to formulate both the DNDP and NIP. Therefore, the third section reviews the MPEC-related existing papers. This thesis considers the interaction of TN-SCN, and hence the following section presents the review on the development of SCNE models and agricultural SCNs. Due to the exact solution methods are not available for solving the proposed MPEC model, metaheuristic solution methods need to be applied. The metaheuristic procedures are thus reviewed in the seventh section by focusing on the particle swarm optimization (PSO) algorithms, which have rarely been explored in the NDP. In the last section, the gaps between the existing literatures and this thesis are made clear, and the contribution of this thesis is identified.</p> <p>The previous chapters showed the importance of model for freight TN design that considers the TN-SCN interactions. In <u>Chapter 3</u> the framework of a freight TN design model is presented, which takes into consideration the TN-SCN interactions. The model is undertaken within the framework of MPEC.</p> <p><u>Chapter 4</u> discusses the SCN equilibrium (SCNE) models, which is utilised in the lower level. First section contains the first SCNE model, which considered the behaviour of freight carriers. Although, this model can be used for investigating the impact of freight transport-related policies on the whole supply chain of a product. Nevertheless, this model is designed for tackling the SCN of an industrial product, and thus, it is not appropriate for dealing with the SCN of agricultural products. In addition, the direct transaction from the first to third tiers is not allowed in this model. Therefore, this thesis formulates a multi-channelled SCNE model with the behaviour of freight carriers.</p> <p>The upper level problem is described in Chapter 5, which represents the behaviour of</p>			

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<p>administrators/planners in making investment decision for developing freight TNs. The objective function of the upper level is to maximise the rate of profit, namely the ratio of the increase in total surplus with the actions implemented as compared to without them to the investment/operational cost required for implementing them. In this research, it is assumed that there is no restriction to the investment budget, even though this could be possible by involving additional procedures (e.g. penalty method) within the solution procedures for the upper level. In addition, this chapter also shows that the DNDP has possibility turn into the NIP by changing the perspective of objective function.</p> <p>In <u>Chapter 6</u> the applications of proposed model are conducted. The first application of the model is used to find the proper parameters of PSO algorithms, since the values of its parameters significantly affect their performance. Within the framework of MPEC, the supply chain–transport supernetwork equilibrium (SC–T–SNE) is incorporated in the lower level, where the upper level determines the best combination of actions using PSO algorithms. The combination of actions, which maximise the efficiency of SCN, is selected as the solution. The several important parameters are tested, which is noted by the existing PSO-related researches, such as inertia weight, the maximum velocity and minimum one, the maximum linear pseudo probability and minimum one and the learning factors.</p> <p><u>Chapter 7</u> presents the application of freight TN design to cocoa SCN in Sulawesi, Indonesia within the framework of MPEC. The proposed MPEC model consists of two levels for both the DNDP and NIP. The lower level involves the multi-channelled SCNE, which is able to estimate the prices of cocoa beans (hereafter, simply referred to as cocoa) and the amount of cocoa transacted (i.e. those transported or distributed). The upper level optimises the combination of improvement actions for the case of DNDP by maximising the rate of profit or that of disrupted links in TN for the case of NIP by maximising the loss of profit.</p> <p><u>Chapter 8</u> concludes the research and proposes future research topics.</p>			